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THE DEMAND FOR MONEY IN PAKISTAN: A DISAGGREGATED ANALYSIS

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THE DEMAND FOR MONEY IN PAKISTAN
A DISAGGREGATED ANALYSIS

The demand for money has been extensively studied in both developed and less developed countries in recent years. In Pakistan various authors [1,3,16,23,25] have estimated the money-demand function in aggregate form in order to explore the determinants of demand for money. They have found income, rate of interest, expected rate of inflation and effect of monetization as important determinants. While an aggregate equation may provide satisfactory results about money holdings, it is likely that such an aggregation may conceal important information about the demand for its components. There is a general belief [8,11] that motives for holding different components of money stock (assuming money market in equilibrium), viz. currency, demand deposits and time deposits, are not necessarily the same, and different components of money stocks are generally held by different groups of money holders. Therefore, if money-demand function is estimated in disaggregated form, it may shed more light on the demand for money in Pakistan than the aggregate function used by various authors [1,3,16,23,25]. Furthermore, disaggregation provides greater flexibility in the choice of policy variables for the conduct of monetary policy. In this paper, we have examined the money-demand function in disaggregated form, wherein separate equations are estimated for currency, demand deposits and time deposits. To the best of our knowledge, no previous work has been done in this area for Pakistan.

This paper is divided into five sections. In section I, we specify the function to be estimated and discuss the methodological

issues and data. The regression results are reported in section II. A comparison between aggregated and disaggregated money demand function is presented in section III. Section IV contains policy implication while the final section highlights the major conclusions of this study.

The Model and The Methodology

In the study we used the money-demand function which has received extensive 'theoretical' and 'empirical' treatment by various authors [1,2,7,8,10,11,16] in both developed and less developed countries. This function has been used in estimating the demand for money in aggregate form. Since the purpose of this study is to estimate the money-demand function in disaggregated form, the same general function may be used in estimating the components of money stock[1]. Since currency in circulation is one of the components of money stock, we may write the demand for currency as:

$$CC^* = A\ Y_t^{\alpha}\ R_t^{\beta} \quad \ldots \quad \ldots \quad \ldots \quad \ldots \quad (1)$$

where CC* is the desired amount of currency in circulation, Y is the real income (GNP) and R represents the opportunity cost variable. It is expected that the partial derivatives will have the following signs.

$$\partial CC^*/\partial Y > 0, \quad \partial CC^*/\partial R < 0$$

A vast number of empirical studies[2] have examined the money-demand function in great detail, considering the questions such as the

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1 Money stock is defined here as currency in circulation plus demand deposits plus time deposits. Although the choice of broader definition of money (M_2) is debetable yet in an unpublished study made at the Pakistan Institute of Development Economics, the empirical evidence for Pakistan suggests that degree of substitution between M_1 and time deposits exist and broader definition can be used. Furthermore Goldfeld [8] argued that evidence from the annual data tends to favour M_2 over M_1.

2 See [5,7,8,13,19].

relevant scale variable (real income, permanent income, wealth) and the choice of the variable that most closely approximates the opportunity cost of holding money. Although theoretically there is a consensus on the selection of appropriate scale variable[3] but empirically for Pakistan there appears to be no concensus[4]. However, in an earlier study [16] it was found that measured income and permanent income elasticities were exceedingly close to each other so that measured income could be used as an explanatory variable in place of permanent income. This finding was supported by the evidence given by Laumas & Laumas [20], Adekunle [2], Mammen [22] and Liu [21]. Therefore, in our specification of currency equation we used measured income as scale variable.

The importance of the rate of interest in money-demand function has been firmly established, at least theoretically. However, there is no concensus as to which interest rate is the relevant opportunity cost for holding money. Some writers [6] argued in favour of long term interest rate and some [5,13,19] in favour of short term while some writers [2,10,17,26,28] have argued that interest rate does not play a significant role in demand for money in less developed countries. However, in an earlier study[5] it is found that interest rate does play an important role in the demand for money in Pakistan and for that matter, rate of

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3. The selection of appropriate scale variable depend on which theory one believe. For example, the level of income has played an important role in the empirical tests for transaction based theories of the demand for money. Wealth variable has been preferred in portfolio analysis while Friedmanian type of money demand function argues in favour of permanent income.

4. For example, see [16, 23]

5. See [16].

interest on time deposit was significant variable. Since we are estimating the money-demand function in disaggregated form, we have classified the time deposit rate into short term and long term rate, the short term being 0-6 months time deposit rate and the long term as that of 6 months or more. In our specification of the demand for currency we used short-term time deposit rate (r_T^S) as an opportunity cost variable. This is because currency in circulation is the amount people demand for transactions purposes, they are willing to postpone their present consumption for short period only if they can earn a reasonable rate of return by putting their assets in time deposits. However, long-term time deposit rate (r_T^L) has also been used as an opportunity cost variable. Although theoretically, r_T^S is more plausible yet r_T^L has its own significance. When the people have portfolio choice problem they have two options — they can either keep currency in their hand or put part of the currency in some interest-bearing assets. Since in Pakistan asset holders do not hold larger amounts of government securities, corporate bond etc., the only interest - bearing asset left is time deposits. Therefore, time deposits are held generally for precautionary motive and this has important bearing in view of the fact that the vast majority of the people live near the subsistence level and they would like to hold interest-bearing assets for precautionary measure. Therefore, r_T^L seems to be a relevant constraint variable in currency-demand-function.

Demand for Demand Deposits

The demand for demand deposits may also be written as

$$DD^* = A\, Y_{na}^{\alpha} \quad R_t^{\beta} \qquad \ldots\ldots(2)$$

where DD* is the desired amount of demand deposits, Y_{na} is the real non-agriculture income and R is the opportunity cost variable. It is expected that the partial derivatives will have the following signs:

$$\partial DD^*/\partial Y_{na} > 0, \quad \partial DD^*/\partial R < 0$$

As different components of money stock are generally held by different groups of people, we argue that the demand deposits are mostly held by the business sector. The more appropriate scale variable would be the non-agriculture income rather than national income . Furthermore, owing to the existence of a sizable non-monetized sector, the use of non-agriculture income as a scale variable in the specification of demand for demand deposits is further strengthened. As far as opportunity cost of holding money is concerned, business community do not want to keep their money for longer period in time deposits. Therefore, short-term time deposit rate is used as the opportunity cost of holding demand deposits. Furthermore, inter-bank call-money rate (r_c) has also been used as an opportunity cost variable. The plausibility of this variable in the specification of demand for demand deposits needs comment. The demand for demand deposits reflects the demand in business sector for financing the business activity. Borrowing from commercial bank takes place in the wake of financing the business activity. After exhausting the time deposits in commercial bank if further demand exists in business sector, then commercial bank has only two choices. It can borrow either from State Bank or from commercial banks. Generally, in order to meet the demand of business sector short-term inter-bank borrowing takes place and this affects the r_c. Therefore, r_c also seems to be a plausible constraint variable in demand deposit function.

Demand for Time Deposits

Demand for time deposits is a function of national income (Y) and a vector of interest rate (R), and is written in functional form as

$$TD^* = A\ Y_t^{\alpha}\ R_t^{\beta} \qquad \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots(3)$$

where TD* is the desired amount of time deposits. It is expected that the partial derivatives will have the following signs:

$$\partial TD^*/\partial Y>0,\ \ \partial TD^*/\partial R\gtrless 0$$

Rate of return on time deposits has been used as an opportunity cost variable and we expect a positive sign with time deposits. Furthermore, we also used government bond rate (r_g) as a proxy candidate for r_t. This is because government bonds are usually considered to be the substitute for time deposits and we expect a negative sign using r_g. We used national income as a scale variable because time deposits are probably held by every section of the people for expected capital gains.

This specification completes our basic identity as

$$M^d = CC + DD + TD \qquad \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots(4)$$

i.e. total money demand is currency in circulation plus demand deposits plus time deposits.

It is assumed in this paper that actual and desired money balances (or its components) may not be equal in the contemporaneous period; therefore, a specific stock adjustment process is specified. The most commonly used adjustment mechanism can be formalized as

$$(M_t/M_{t-1}) = (M_t^*/M_{t-1})^{\theta} \qquad \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots(5)$$

where θ represents the co-efficient of adjustment — the speed at which actual money holdings (or its components) adjust to the desired level.

It is constrained[6] such that $0 \leq \Theta \leq 1$.

Recently Goldfeld [9] and White [27] pointed out an important distinction between real and nominal adjustment mechanisms. The two adjustment mechanisms are given as follows in logarithmic form:

$$\ln m_t - \ln m_{t-1} = \Theta(\ln m_t^* - \ln m_{t-1}) \quad \ldots \quad \ldots \quad (6)$$

$$\ln M_t - \ln M_{t-1} = \Theta(\ln M_t^* - \ln M_{t-1}) \quad \ldots \quad \ldots \quad (7)$$

with $M_t^* = m_t^* P_t$ or $m_t^* = M_t^* = M_t^*/P_t$

Combining (1) and (7) yields[7]

$$\ln (CC/P_t) = \Theta\alpha_0 + \Theta\alpha_1 \ln y_t + \Theta\alpha_2 \ln R_t + (1-\Theta) \frac{\ln(CC_{-1})}{P_t} \quad \ldots \quad \ldots \quad (8)$$

while combining (1) and (6) yields the same equation except that the lagged dependent variable is deflated by lagged price level, i.e. CC_{-1}/P_{t-1}.

Thus the only difference between the estimation of the real adjustment mechanism (equation 6) and that of the nominal adjustment mechanism (equation 7) is the form of the lagged dependent variable. In the nominal adjustment version, lagged nominal money balances (or its components) are deflated by current prices, and in the real adjustment version, they are deflated by lagged prices.

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6 If $\Theta=1$, $M_t^*=M_t$, indicating that the desired money balances are equal to actual money balance and if $\Theta=0$, $M_t=M_{t-1}$, indicating no adjustment is made between actual and desired money balances. The closer Θ is to zero the slower is the adjustment.

7 The components of money stock will be substituted in M_t.

Goldfeld [9] and White [27] criticized the real adjustment mechanism on the grounds that the change in money balances due to a price-level change will not occur instantaneously because such adjustments are costly[8]. Furthermore, Goldfeld argued that

> Although in the previous section and in most of my work I relied on the real adjustment model, I now think it more plausible to use the nominal adjustment model.

Therefore, equation (8) will be estimated to obtain the short-run income and interest-rate elasticities alongwith the speed of adjustment between actual and desired money balances. Similarly, for demand and time deposits, the following equations specified in the pattern of (8) will be estimated to obtain short-run elasticities and the co-efficients of adjustment.

$$\ln (DD/P_t) = \theta\alpha_0 + \theta\alpha_1 \ln y_{na} + \theta\alpha_2 \ln R_t + (1-\theta) \ln \frac{(DD_{-1})}{P_t} \quad \ldots \quad \ldots \quad \ldots \quad (9)$$

and

$$\ln (TD/P_t) = \theta\alpha_0 + \theta\alpha_1 \ln y_t + \theta\alpha_2 \ln R_t + (1-\theta) \ln \frac{(TD_{-1})}{P_t} \quad \ldots \quad \ldots \quad \ldots \quad (10)$$

To capture the effect of growing monetization of the economy and its impact on the demand for the components of money stock we used the number of bank branches as an explanatory variable. We expect a positive sign with demand and time deposits and a negative sign with currency in circulation.

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8 See [12].

In order to investigate the effect of expected rate of inflation on the demand for the components of money stock we used the following definition, as a proxy for the expected rate of inflation.

$$P^{\cdot}_{t} = \frac{P_{t} - P_{t-1}}{P_{t-1}} \quad \ldots \quad \ldots \quad \ldots \quad \ldots \quad \ldots \quad \ldots \quad \ldots \quad (11)$$

A stable demand for money function (disaggregated form) is crucial for the effectiveness of the monetary policy since it provides an essential link in the transmission mechanism of monetary policy. Furthermore, one of the purpose of this paper is to forecast the components of money stock, therefore, accuracy of prediction will depend on the stability of the model. To test the stability of money-demand function in disaggregated form we have used covariance analysis[9]. We used dummy variable in both additive and multiplicative fashion giving zero to 1959-71 and one to 1971-73. In the former case to allow for differential slopes. We estimated separate regressions using the more general model,

$$\ln M^{*}_{t} = \alpha_{0} + \alpha_{1} \ln y_{t} + \alpha_{2} \ln R_{t} + \alpha_{3} D + \alpha_{4} D(\ln y_{t}) + \alpha_{5} D(\ln R_{t}) \quad \ldots \quad \ldots \quad (12)$$

In disaggregated form, the components of money stock will be used in the place of total desired money stock (M^{*}_{t}) as endogenous variable.

For measuring the accuracy of prediction, Theil developed an inequality coefficient. This coefficient was originally developed for measuring the accuracy of prediction of changes in variables[10]. For our analysis, we followed Klein [18] and used it as measure of the accuracy of prediction of levels. The measure used is

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9 See Johnston [14].

10 See [4].

$$Z = \sqrt{\Sigma (M_t^f - M_t)^2 / \Sigma M_t^2} \quad \ldots \quad \ldots \quad (13)$$

where M_t^f and M_t are forecast values and actual values in year t respectively. This co-efficient will be zero when M_t^f is equal to M_t for all years.

THE DATA

The data used are annual[11] observations of the variables for the period 1959-60 to 1977-78. The data regarding the components of money stock are taken from [15]. All the data used in this paper are in the constant price of 1959-60. A list of symbols and their definitions is given below:

CC = Currency in circulation

DD = Demand deposits

TD = Time deposits

Y = Gross National Product

Y_{na} = Non-agriculture income

r_T = Rate of interest on time deposits

r_T^S = Short-term time deposit (0-6 months)

r_g = Government bond rate

B = Number of bank branches

r_c = Inter-bank Call Money Rate

r_T^L = Long-term time deposit rate (6 months and above)

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11 Ideally, it might have been better to use quarterly data instead of annual because in that case it would have increased our degree of freedom and would have taken care of within the year movements. Secondly, quarterly data is more important for policy implications. However lack of quarterly data of important variable such as GNP prompted us to depend on annual observations.

II. THE RESULTS

Demand for Currency

The estimated coefficients of demand for currency in circulation are reported in Table I. The table shows that income and interest rate elasticities possess the anticipated sign and are significantly different from zero. We used both short-term and long-term time deposit rates as an opportunity cost variable. The table shows that the long-term time deposit rate (r_T^L) has performed better than the short-term time deposit rate (r_T^S) when used with income variable. The income elasticity rose to 1.50 from 1.25, and the interest rate elasticity rose to 0.73 from 0.53 when (r_T^L) was used. As mentioned earlier, the short-term time deposit rate (r_T^S) is more plausible than (r_m^L) because currency is used for transaction purposes and people can postpone their present consumption for short period only if they can earn a reasonable rate of return by putting their assets in time deposits. We found (r_T^S) significantly different from zero. However, keeping in view the fact that a vast majority of people live near the subsistence level in Pakistan, one can safely say that they would like to hold interest-bearing assets for precautionary motive. Therefore, long-term time deposits are generally held for expected capital gain[12]. We found (r_T^L) a highly significant variable in currency equation. This has improved our results considerably. We also used the weighted average of time deposits rate (r_T) as opportunity cost variable along with income variable and found income and interest rate elasticities exceedingly close when used with r_T^L and income variable. Therefore, it is our contention

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12 Rate of return on long term time deposits were always higher than short term time deposits. For expected capital gain people would prefer to hold long term time deposits.

Table 1: Estimated Co-efficients of Demand for Currency

Equation No.	Constant (c)	Y	r_T^L	r_T^S	r^T	B	R^2	DW	F
(1)	-8.45 (-7.14)*	1.25 (9.34)*		-0.53 (-5.79)*			0.95	1.84	151.63
(2)	-10.48 (-7.52)*	1.50 (9.73)*	-0.73 (-6.34)*				0.95	2.19	173.06
(3)	-10.23 (-7.87)*	1.47 (10.25)*			-0.71 (-6.61)*		0.96	2.24	184.51
(4)	-8.84 (-6.89)*	1.31 (9.17)*		-0.52 (-5.57)*		-0.02 (-0.83)	0.95	1.81	99.40
(5)	-10.68 (-7.30)*	1.52 (9.30)	-0.71 (-6.00)*			-0.01 (-0.58)	0.96	2.10	110.68
(6)	-10.44 (-7.62)*	1.49 (9.76)*			-0.69 (-6.27)*	-0.01 (-0.61)	0.96	2.15	118.29

Notes:- All the equations are estimated in log-linear form. C is the intercept term, Y is the real GNP, r_T^L is the long term time deposits rate, r_T^S is the short term time deposits rate, r_T is the rate of interest on time deposits and B is the number of bank branches. The t-values are given in paranthesis and a star(*) indicates that co-efficients are statistically significant at 95% confidence level.

that the distinction between long-term and short-term time deposits rates is not desirable keeping in view the fact that people would prefer to hold long-term time deposits for expected capital gain. The effect of expected rate of inflation on demand for currency in circulation comes out insignificant. This is not completely surprising in Pakistan as inflation was not a problem till 1971. In order to investigate the effect of monetization on currency demand we used the number of bank branches as explanatory variable in our specification and found this variable statistically insignificant although it possessed the expected sign. This is not surprising because the impact of monetization on currency in circulation was rather slow. This is quite obvious from Figure I. The figure shows that currency in circulation was always higher than demand and time deposits till 1970-71. After that, demand deposits surpassed the currency in circulation. It is important to note that the Durbin-Watson statistic is high enough in each equation to suggest that there is no serial correlation. Furthermore, the income elasticity of demand for currency is greater than unity which implies that a large preference for cash in the Pakistan economy still prevail.

Demand for Demand Deposits

The estimated coefficients of demand for demand deposits are presented in Table 2. The table shows that income and interest rate elasticities possess the anticipated sign and the coefficient of Y_{na} (non-agriculture income) is statistically significant while the coefficients of r_T^S or even r_T are statistically insignificant. The rate of interest on time deposits does not seem to have affected the demand deposits significantly. This is also not very surprising to us. The rate of interest

does come out with its expected negative sign, although it is significant. This implies that there was possibly some switch from demand deposits to time deposits as a result of the change of rate of interest but that the switch was not large enough to be significant in the demand-deposit function during that period. This is quite obvious from Table 1 in the Appendix. The ratio of demand deposits to time deposits declined at a slow rate till 1969-70 and since then the ratio has been increasing. This implies that substitution between deposits and time deposits due to the changes of interest rate on time deposits has taken place at a slow rate. On the other hand, substitution between currency in circulation and time deposits has taken place at a reasonably faster rate due to changes in the interest rate of time deposits. Therefore, we argue that the rise in the time deposits seems to have been mostly at the cost of currency in circulation rather than at the cost of demand deposits[13]. Hence it is not surprising that the rate of interest on time deposits did not come out significant in the demand-deposits function but as was expected, turned out significant in the currency-demand function.

As far as inter-bank call-money rate (r_c) is concerned, it turned out statistically significant. As mentioned earlier, the demand for demand deposits reflects the demand in business sector for financing the business activity. After exhausting the time deposits in commercial banks if further demand exists in business sector then in order to meet the demand short-term inter-bank borrowing takes place and this affects r_c. This is exactly what seems to have happened in Pakistan during the period under consideration. This finding is supported by Gupta [11] for Indian economy.

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13 The findings of Niazi [24] support our contention.

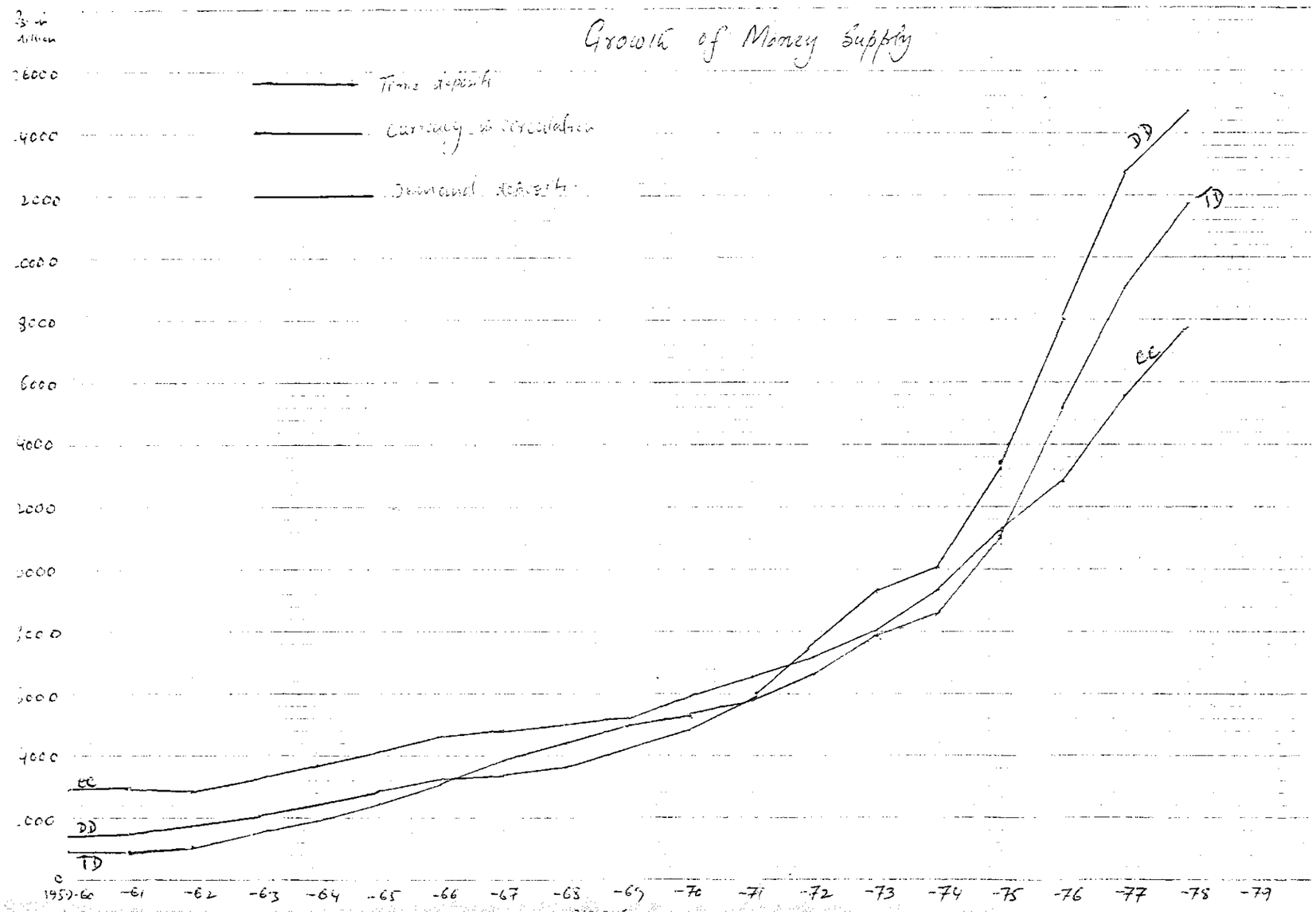
Growth of Money Supply
Billion
Time deposits
Currency in circulation
Demand deposits
DD
TD
CC
CC
DD
TD
0
1959-60
-61
-62
-63
-64
-65
-66
-67
-68
-69
-70
-71
-72
-73
-74
-75
-76
-77
-78
-79

Table 2:- Estimated Co-efficients of Demand for Demand Deposits and Time Deposits

Equation No.	Dependent Variable	Constant (C)	Y	Y_{na}	r_c	r_g	r_T	R_T^S	B	R^2	DW	F
(1)	DD	-10.56 (-4.12)*		1.47 (4.78)*				-0.12 (-0.59)		0.96	1.35	214.25
(2)	DD	-10.58 (-4.12)*		1.46 (4.78)*			-0.12 (-0.43)			0.96	1.35	212.08
(3)	DD	-12.26 (-8.89)*		1.66 (10.44)*	-0.24 (-2.17)*					0.97	1.65	273.93
(4)	DD	-9.93 (-4.75)*		1.35 (5.41)*				-0.19 (-0.92)	0.07 (1.46)**	0.97	1.52	153.69
(5)	TD	-32.47 (-7.75)*	3.72 (8.07)*					-1.41 (-4.13)*		0.96	1.41	192.45
(6)	TD	-20.06 (-5.61)*	2.38 (5.96)*			-0.57 (-1.38)				0.93	0.78	100.6
(7)	TD	1.30 (4.97)*					1.29 (8.19)*			0.80	0.31	
(8)	TD	-32.35 (-7.20)*	3.70 (7.42)*				-1.42 (-3.95)*		0.007 (0.10)	0.96	1.40	120.36

Note:- All the equations are estimated in log linear form. Y_{na} is the real non-agriculture income, r_c is the inter bank call money rate, r_g is the annual yield on Govt. bond. Rest of the variables are defined in Table 1. A double star(**) indicates that the co-efficients are statistically significant at 90% level.

The expected rate of inflation did not come out significant in demand-deposit function. The reason is already stated. However, the effect of monetization on demand-deposit function is significant at the 90 percent confidence level. This implies that over time growth in banking habit led, to some extent, to substitution between currency and demand deposits. This is also what Table 1 in the Appendix shows. Furthermore, doing the covariance analysis in order to investigate the effect of monetization during the post - 1971 period on demand deposits we found the coefficient of bank branches as highly significant for the post - 1971 period and insignificant with the expected sign for the pre-1971 period (see Table 4.a). This implies that the effect of monetization on demand deposits was highly significant during after 1971.

Demand for Time Deposits

Presented in Table 2 are the estimated coefficients of demand for time deposits. Income and interest rate (r_g) elasticities posses the anticipated sign and the co-efficient of r_g (Govt. bond rate), though possessing expected sign, is statistically insignificant. The government bond rate (r_g) does not seem to have affected the time-deposit function significantly. This implies that there was possibly some switch from time deposits to Government bond as a result of the change in the rate of interest on Govt. bond but that switch was not large enough to be significant in the time-deposit function. As far as interest rate on time deposits (r_T) is concerned, we expected a positive sign in accordance with the argument that r_T is a reward on time deposits. However, we got a negative sign with a high coefficient. It is worth noting that when r_T was used with income variable, we got wrong sign for interest rate, while, on the other hand, when income variable was dropped and only r_T was used as

explanatory variable we got positive sign for r_T and the coefficient was statistically significant. But the Durban-Watson statistic shows severe auto-correlation problem which implies an omission of an important explanatory variable (y) from the specification.

There are two possible reasons - one statistical and the other qualitative - for the wrong sign of r_T. First, the correlation between (Y) and r_T is as high as 0.98 and we got the wrong sign for r_T only when it was used with (Y). Secondly, theoretically when r_T goes up, so do time deposits, but, as mentioned earlier, Govt. bond is considered substitute for time deposits, therefore, an increase in r_T is not necessarily an increase in time deposits because the relative profitability of putting assets in Govt. bond is higher[14]. This is also obvious from our findings that some switch from time deposits to Govt. bond has taken place.

We did not find the expected rate of inflation significantly affecting the time-deposit function. The reason was stated earlier. However, the effect of monetization, for which the number of bank branches was used as proxy, possessed the expected sign but was statistically insignificant. This implies that to some extent the growth in banking habit over time led to substitution between currency and time deposits. Furthermore, doing the covariance analysis we found that the impact of monetization was significant after 1971. The coefficient of bank branches was insignificant with wrong sign for the pre-1971 period and significant with expected sign for the post-1971 period (see Table 4.a).

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14 The rate of return in Govt. bond (r_g) was higher than rate of return on time deposits (r_T) from 1959-60 to 1971-72.

Presented in Table 3 are the estimated coefficients of currency in circulation, demand deposits and time deposits using equations 8, 9 and 10. The coefficient of lagged variable (CC_{-1}) is statistically significant and the coefficient of adjustment[15] (θ) varies between 0.58 - 0.64. This implies that 58 - 64 percent of discrepancy between the actual and desired currency holding is eliminated in one year. It may be pointed out that short-run income and interest rate elasticities[16] using r_T^L with income and r_T with income are exactly the same. Therefore, it further support our contention that distinction between short-term and long-term interest rates is not desirable and we can use r_T as an opportunity cost variably confidently. It may further be pointed out that there is a marked differences between the short-run and long-run income and interest rate elasticities because adjustment between actual and desired currency holdings is not instantaneous.

The coefficient of lagged dependent variable (DD_{-1}) in the demand-deposit function is statistically significant and the coefficient of adjustment (θ) is 0.31, suggesting that about 31 percent of the discrepancy between actual and desired levels of demand deposits is eliminated in one year. Similarly, for time-deposit function the lagged dependent variable (TD_{-1}) is also statistically significant and the coefficient of adjustment (θ) is 0.19 implying that only 19 percent of discrepancy was eliminated in one year.

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15 The coefficient of adjustment (θ) is obtained from (1-coefficient of lagged dependent variable used as explanatory variable).

16 Using lagged dependent variable as explanatory variable in the specification gives us short run elasticities. See Chow [7], Gupta [11], Gujrati [10], Goldfeld [8].

Table 3: Estimated Co-efficients of Demand for Currency, Demand Deposits and Time Deposits

Equation No.	Dependent Variable	Constant (C)	Y	Y_{na}	r_C	r_g	r_T	r_T^L	r_T^S	Lagged Dependent Variable	R^2	DW	F
(1)	CC	-7.54 (-6.96)*	0.80 (4.24)*						-0.32 (-3.06)*	0.42 (3.14)*	0.96	2.85	128.82
(2)	CC	-8.51 (-5.76)*	0.96 (3.70)*					-0.44 (-2.83)*		0.37 (3.35)*	0.96	2.64	120.86
(3)	CC	-8.48 (-6.03)*	0.96 (3.88)*				-0.44 (-2.97)*			0.36 (2.36)*	0.96	2.74	125.40
(4)	DD	-7.36 (-3.15)*		0.51 (1.24)					-0.09 (-0.48)	0.75 (3.0)*	0.97	1.50	186.14
(5)	DD	-8.69 (-5.17)*		0.72 (2.14)*	-0.19 (-1.80)*					0.69 (3.02)*	0.98	1.74	226.60
(6)	DD												
(7)	TD	-7.90 (-1.22)	0.53 (0.64)				-0.1 (-0.25)			0.78 (4.08)*	0.98	1.34	213.66
(8)	TD	-6.58 (-2.49)*	0.36 (1.00)			-0.03 (-1.27)				0.81 (6.61)*	0.98	1.32	212.91
(9)	TD												

Note:- All the variables are defined in table 1 and 2.

As mentioned earlier, stable money-demand function (in disaggregated form) is crucial for effectiveness of the monetary policy. Furthermore, one of the purposes of this paper is to forecast the components of money stock. Therefore, accuracy of prediction will depend on the stability of the model. To test the stability of money-demand function in disaggregated form we have used the covariance analysis. The estimated coefficients of the components of money stock are presented in Table 4. The analysis shows that the differences in both intercept and slopes between the two time period viz. pre-and post-1971 years, are statistically significant. These results suggest that the structural shift has taken place in the economy due to inflation. It may be pointed out that the rate of inflation was very low in Pakistan until 1971 but increased at a compound growth rate of 15 percent thereafter. Our study found that the estimated coefficient of the expected rate of inflation was insignificant for the period 1959-60 to 1970-71 while it turned out to be significantly different from zero after 1971. As stated above, the structural shift in the economy has taken place because of inflation and not with changes in the interest rate. Using rate of interest and income we did not find intercept and slopes significantly different from zero. Therefore, the functions using income and interest rate for currency, demand and time deposits can be used for forecasting purposes.

Forecasting

The components of money stock have been predicted on the basis of the estimated equations for currency, demand deposits and time deposits. The actual and predicted values of currency-in-curculation, demand - and time deposits are reported in Tables 5,6, and 7 respectively. The Z-coefficient used here as a measure of accuracy of prediction is calculated

Table 4(a) Estimated Co-efficients of Demand for Currency, Demand Deposits and Time Deposits by Covariance Analysis

No. of Eq.	Dependent variable	Constant (C)	y	Y_{na}	r_c	r_T	r_T^L	B	D	D(y)	$D(y_{na})$	$D(r_c)$	$D(r_T)$	$D(r_T^L)$	D(B)	R^2	DW	F
1.	CC	1.42 (-5.89)*	1.42 (7.51)				-0.54 (-2.98)*	-0.03 (-2.24)*	8.37 (2.85)*	-1.13 (-3.01)*				-0.14 (-0.53)	0.45 (3.06)*	0.98	2.96	104.95
2.	CC	-9.25 (-6.05)*	1.36 (7.84)*			-0.50 (-3.03)*		-0.03 (-2.27)*	7.41 (2.55)*	-1.05 (-2.83)*			-0.17 (-0.84)		0.47 (3.22)*	0.98	2.96	128.51
3.	CC	-9.55 (-6.34)*		1.34 (7.52)*	-0.06 (-0.60)			0.01 (0.39)	14.85 (3.36)*		-0.59 (-3.94)*	-0.02 (-0.01)			1.36 (4.47)*	0.99	1.45	177.11
4.	DD	-12.14 (-6.82)*	3.52 (5.45)*	1.67 (7.59)*		-0.57 (-2.19)*		0.03 (1.08)	17.32 (3.22)*		-1.07 (-3.99)*		-0.45 (1.09)		1.36 (5.34)*	0.99	2.32	291.32
5.	TD	-31.05 (-5.46)*				-1.01 (-1.67)		-0.003 (-0.06)	31.96 (2.96)*	-2.17 (-3.08)*			0.49 (0.64)		1.37 (2.51)*	0.98	1.28	100.45

Notes: All the variables are defined in tables 1 and 2. D=0 for 1959-60 to 1970-71 and D=1 for 1971-72 to 1977-78.

Table 4: Estimated Co-efficients of Demand for Currency, Demand Deposits and Time Deposits by Covariance Analysis

Equation No.	Dependent variable	Constant (C)	Y_t	Y_{na}	P*	D	$D(Y_t)$	$D(Y_{na})$	$D(P^*)$	R^2	DW	F
(1)	CC	-3.68 (-7.14)*	0.72 (13.98)*		0.09 (2.39)*	7.71 (5.21)*	-0.71 (-5.09)*		-0.13 (-3.78)*	0.97	1.68	82.78
(2)	DD	-8.57 (-12.61)*		1.23 (17.20)*	0.005 (0.38)	5.42 (2.72)*		-0.47 (-2.38)*	-0.21 (-3.78)*	0.99	2.33	228.36
(3)	TD	-21.62 (-15.22)*	2.45 (17.30)*		0.005 (0.21)	16.75 (4.11)*	-1.57 (-4.08)*		-0.20 (-2.18)*	0.98	1.19	118.84

Note: All the equations are estimated in log linear form. P* is the expected rate of inflation and D is the dummy variable and is zero for the period 1959-60 to 1970-71 and one for the period 1971-72 to 1977-78. Rest are defined in tables 1 and 2.

Table 5

CURRENCY IN CIRCULATION

$$\ln CC = -10.23 + 1.47 \ln Y - 0.71 \ln Y_T$$

	Actual	Predicted	Error of Prediction	
1959-60	2863.32	2711.26	-0.05	
1960-61	2882.86	2631.13	-0.08	
1961-62	2783.31	2738.51	-0.01	
1962-63	3207.76	3056.94	-0.04	
1963-64	3368.99	3344.83	-0.007	Z = 0.02947
1964-65	3671.13	3551.66	-0.03	
1965-66	4033.88	3659.82	-0.09	
1966-67	3826.59	3696.61	-0.03	
1967-68	4008.86	3771.28	-0.06	
1968-69	4090.99	3886.13	-0.05	
1969-70	4469.06	4338.00	-0.03	
1970-71	4629.71	4249.84	-0.07	
1971-72	4854.88	4252.11	-0.02	
1972-73	4634.06	4381.60	-0.05	
1973-74	4407.73	4252.11	-0.03	
1974-75	4143.27	4004.43	-0.03	
1975-76	4219.52	4085.38	-0.03	
1976-77	4664.66	4167.91	-0.10	
1977-78	4926.24	4989.89	0.01	
1978-79	6279.00	5405.49	-0.14	

Table 6

Demand Deposits

$$\ln DD = -12.26 + 1.66 \ln Y_{na} - 0.24 \ln r_c$$

	Actual	Predicted	Error of Prediction
1959-60	1496.91	1564.26	0.04
1960-61	1459.40	1611.90	0.10
1961-62	1686.69	1694.55	0.004
1962-63	1960.68	2049.13	0.04
1963-64	2316.55	2219.79	-0.04
1964-65	2567.10	5202.81	-0.02
1965-66	2805.89	2966.59	0.05
1966-67	2766.68	2878.92	0.04
1967-68	2854.05	3056.94	0.07
1968-69	3326.71	3623.41	0.09
1969-70	3634.45	4252.11	0.17
1970-71	4146.50	4085.38	-0.01
1971-72	5166.91	4425.64	-0.14
1972-73	5424.87	5245.73	-0.03
1973-74	4706.29	5141.86	0.09
1974-75	4856.09	5682.63	0.17
1975-76	5947.17	6217.79	0.04
1976-77	6804.99	6094.67	-0.10
1977-78	6828.75	7444.05	0.09
1978-79	8008.00	9849.44	0.23

Z = 0.1294

Table 7.

Time Deposits

$$TD = -20,06 + 2.38 \text{ In } Y - 0.57 \text{ In } r_g$$

	Actual	Predicted	Error of Prediction	
1959-60	914.33	1102.32	0.20	
1960-61	869.85	1194.13	0.37	
1961-62	1163.06	1332.98	0.15	
1962-63	1527.10	1548.70	0.01	
1963-64	1856.41	1799.33	-0.03	
1964-65	2208.79	2197.71	-0.005	
1965-66	2694.03	2428.84	-0.09	
1966-67	3045.99	2631.13	-0.13	Z = 0.18
1967-68	3480.82	3087.66	-0.11	
1968-69	3844.05	3344.83	-0.13	
1969-70	3971.45	4085.38	0.03	
1970-71	4138.47	3847.47	-0.07	
1971-72	4465.02	3964.64	-0.11	
1972-73	4603.00	4699.31	0.02	
1973-74	3981.95	5459.81	0.37	
1974-75	4126.18	5797.43	0.40	
1975-76	4991.24	5626.09	0.13	
1976-77	5663.36	5351.70	-0.05	
1977-78	5988.99	7224.04	0.20	
1978-79	6909.00	8226.95	0.19	

for currency-in-circulation, demand-and time deposits. It is 0.03 for currency in circulation and 0.13 for demand deposits and 0.18 for time deposits[17]. The actual and predicted values of the components of money stock for the period 1959-60 to 1978-79 are shown in Figures 2,3 and 4. The Figures show that the actual and predicted values are exceedingly close to each other with few exceptions in time deposits for the period 1973-74 and 1974-75.

As mentioned earlier, inflation rate has played a significant role in money-demand function or in estimation of the components of money stock during the post-1971 period[18]. Using expected rate of inflation as an opportunity cost variable in the place of rate of interest, we estimated the functions for currency-in-circulation, demand-and time deposits for the period 1971-72 to 1977-78. We predicted the components of money stock on the basis of estimated equations for demand-and time deposits and the actual and predicted values along with the errors of prediction are reported in Tables 8 and 9[19]. Comparing Tables 6,7 and Tables 8,9 it is found that the equation using expected rate of inflation for the post-1971 period has performed better than the equation using rate of interest as an opportunity cost variable for the same period. The errors of prediction are relatively smaller in Tables 8 and 9 as compared to Tables 6 and 7. Therefore, it is our contention that for forecasting the demand-and

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17 The Z-coefficient will be zero when actual and predicted values are equal. The closer Z is to zero the more accurate prediction it is.

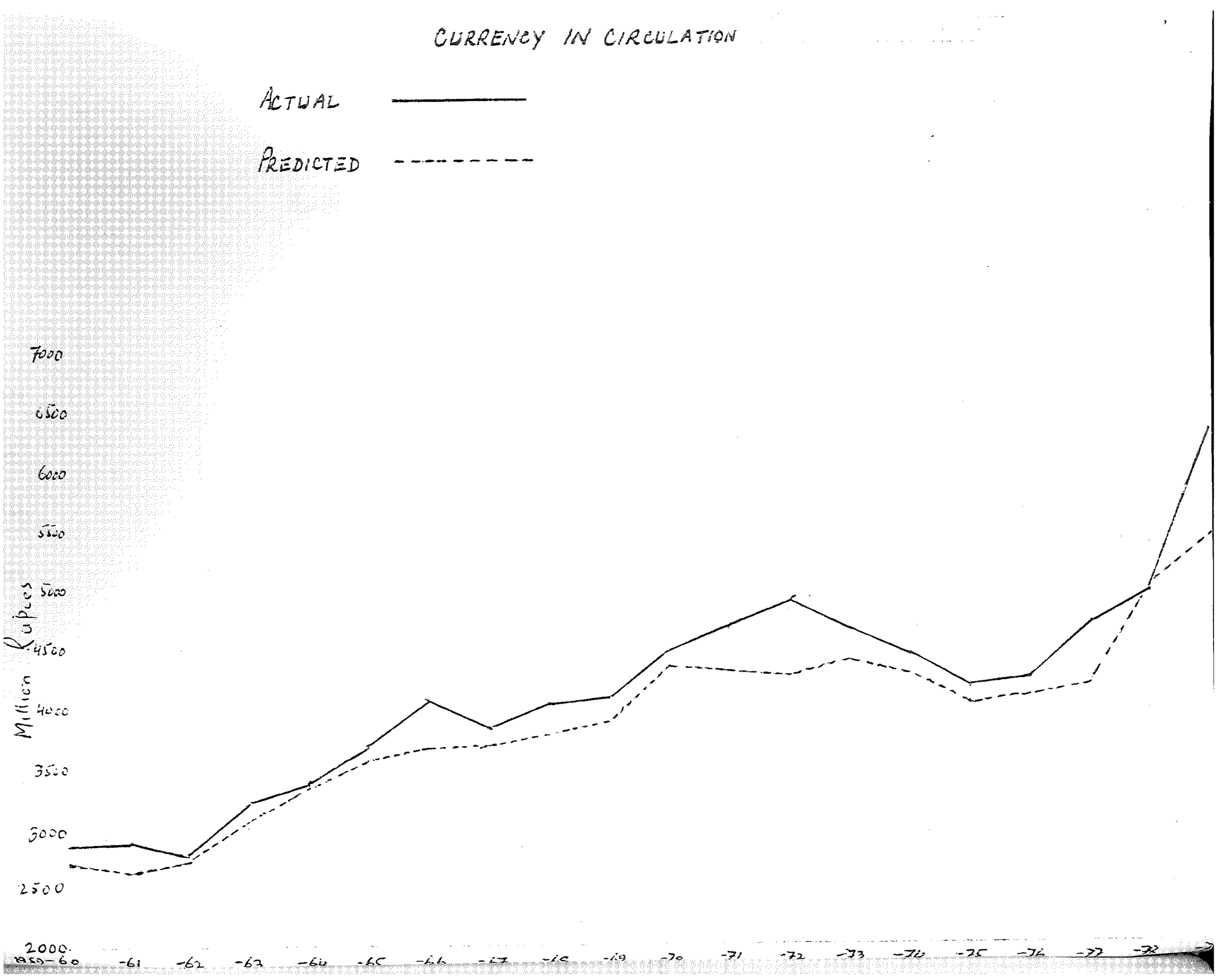
18 See table 4, we found coefficient of expected rate of inflation significant with expected sign after 1971 while in pre-1971 period it was statistically insignificant.

19 The predicted values of currency-in-circulation is not reported here as it did not perform well with expected rate of inflation for the period 1971-78.

CURRENCY IN CIRCULATION

ACTUAL ———————

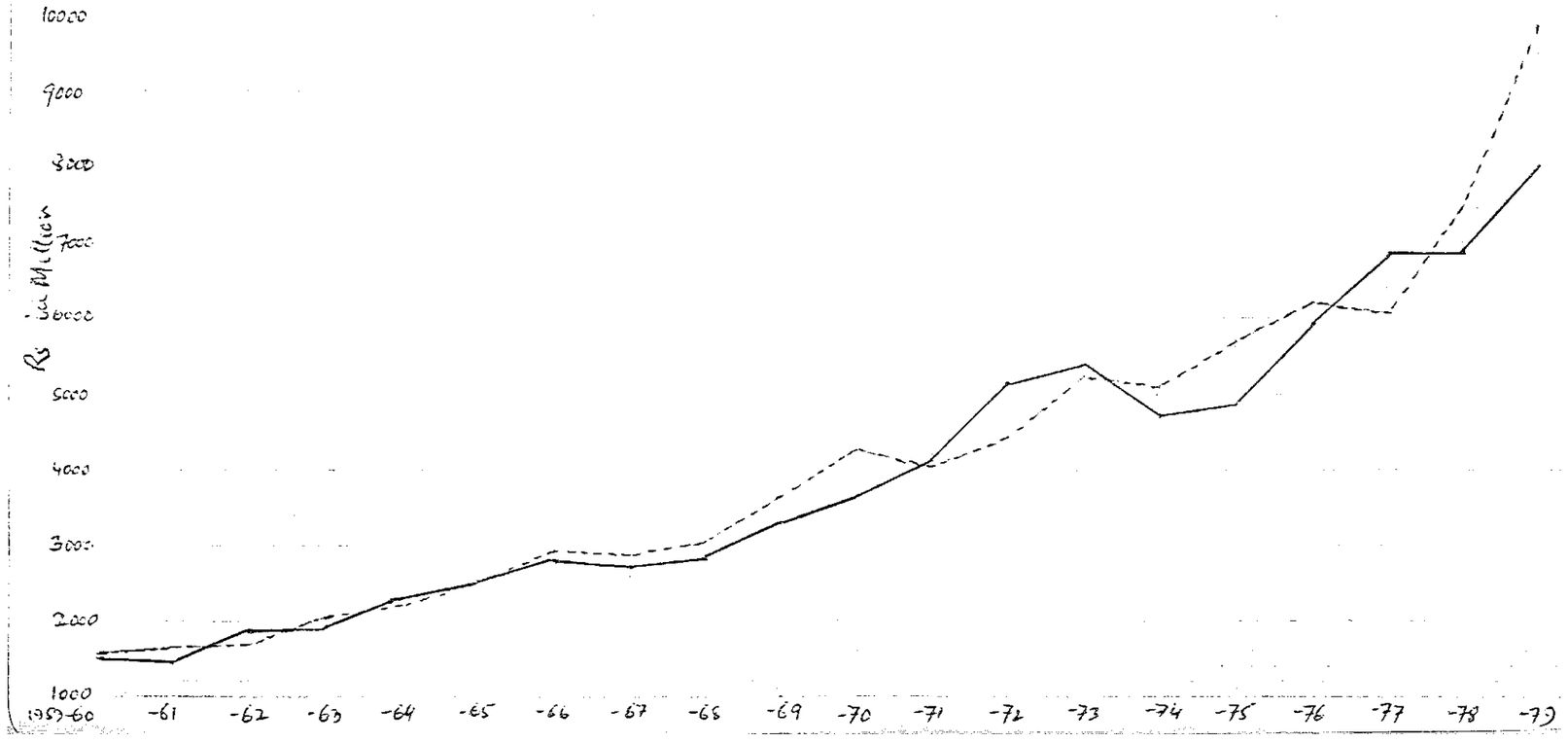
PREDICTED - - - - - - - - -



DEMAND DEPOSITS

ACTUAL ———

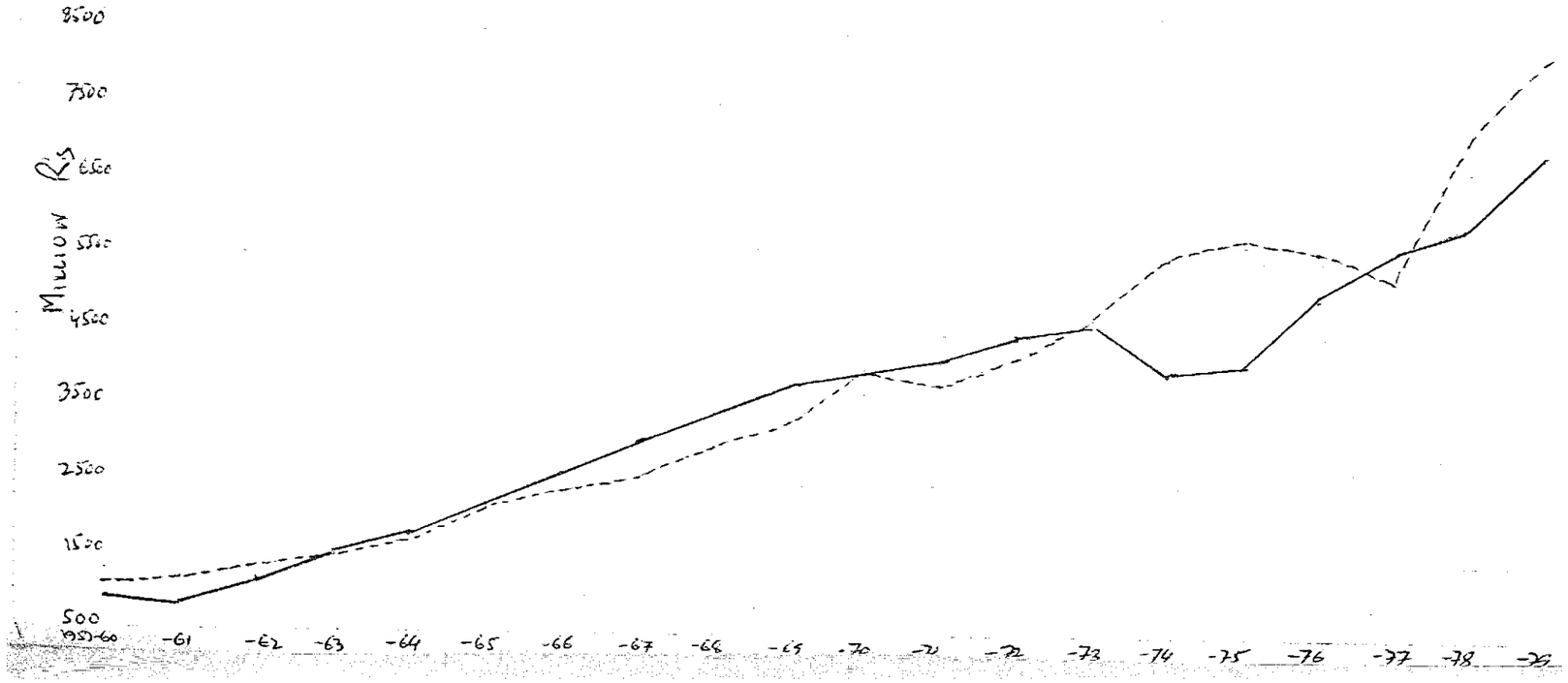
PREDICTED - - - - - - -



TIME DEPOSITS

ACTUAL ———

PREDICTED - - - - - -



time deposits it is better to prefer expected rate of inflation as an opportunity cost variable. For currency-in-circulation it is preferable to use interest rate on time deposits as an opportunity cost variable. We estimated a function for currency-in-circulation for the period 1959-60 to 1974-75 and on the basis of this estimated equation we predicted currency-in-circulation for the period 1975-79 which is reported in Table 10. The errors of prediction are not large. Therefore, this equation can be used for forecasting currency in-circulation.

Comparison Between Aggregated and Disaggregated Money Demand Function

Some rather interesting inferences can be drawn by comparing the results for aggregated money demand function[20] with those for its components. As mentioned in the beginning paragraph of this paper, aggregation may conceal important information about the demand for the components of money stock. Our findings confirm this hypothesis.

In the aggregate equation, interest rate on time deposits (r_T) is found as the most significant interest rate. So is r_T in the currency-in-circulation equation. This is because currency constitutes more than 60 percent of the total money stock (when money stock is defined narrowly), therefore, the variables determining the demand-for-currency are also likely to dominate the equations for the total cash balances demanded. The effect of r_T which is the closest substitute for demand deposits get lost in the aggregate equation because of the small weight attached to the demand deposits in the demand for total money (when money is narrowly defined).

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20 See [16].

Table 8

Demand Deposits

$$DD = -3.15 + 0.76 \ln Y_{na} - 0.20 \ln P$$

	Actual	Predicted	Error of Prediction
1971-72	5166.91	5298.45	0.025
1972-73	5424.87	4891.09	-0.098
1973-74	4706.29	4842.42	0.030
1974-75	4856.09	4842.42	-0.003
1975-76	5947.17	5855.70	-0.015
1976-77	6804.99	6280.28	-0.077
1977-78	6828.75	6940.78	0.016
1978-79	8008.00	8477.49	0.059

Table 9

Time Deposits

$TD = -4.87 + 0.88 \ln Y - 0.19 \ln P$

	Actual	Predicted	Error of Prediction
1971-72	4465.02	489109	0.095
1972-73	4603.00	4470.12	-0.028
1973-74	3981.95	4425.64	0.111
1974-75	4126.18	4381.60	0.061
1975-76	4991.24	5298.45	0.061
1976-77	5663.36	5570.11	-0.016
1977-78	5988.99	6407.15	0.069
1978-79	6909.00	7369.98	0.066

Table 10

Currency in Circulation

$\text{Ln } CC = -10.92 + 1.54 \ln Y - 0.75 \ln r_T$

	Actual	Predicted	Error of Prediction
1975-76	4219.52	4338.00	2.8
1976-77	4664.66	4381.60	-6.07
1977-78	4926.24	5245.73	6.48

Similar loss of information in the aggregate equation can be seen with regard to the role of interbank call-money rate (r_c). The coefficient of r_c is found statistically insignificantly in aggregate equation while it turned out significant in demand-deposit function. Furthermore, the annual yield on government bond (r_g) throughout in aggregate equation was found statistically significant with wrong sign while in the time-deposit function r_g though found statistically insignificant possessed the expected negative sign. This is because government bond is considered a substitute for time deposits. This characteristic gets swamped by the positive sign for r_g in aggregate equation.

At the outset of this paper it is stated that disaggregation provides greater flexibility in the choice of policy variables for the conduct of monetary policy while aggregation limits the choice of policy variables. We selected the non-agriculture income as scale variable in demand-deposit function on the ground that demand deposits is mostly held in business sector and found this variable highly significant. In aggregate equation we used national income as scale variable which also includes non-agriculture income. Therefore, aggregation deprives us of this variable whose effect cannot be investigated independently in aggregate equation. Furthermore, aggregation also limits the choice of interest rate to r_T only while disaggregation provides us with greater flexibility in the choice of the interest rate variable. It allows us to take into consideration the effect of r_c and r_g also.

Policy Implications

The re-examination of money-demand function in disaggregated form confirms our hypothesis that aggregate money - demand function conceals important informations regarding the demand for its components. Estimating the money-demand function in disaggregated form, wherein separate equations are estimated for currency, demand deposits and time deposits, found national income, non-agriculture income, inter-bank call money rate (r_c), time deposit rate (r_T), government bond rate (r_G), expected rate of inflation and effect of monetization as important explanatory variables. These results are extremely useful in formulating the monetary policy of a country.

An effective monetary policy in a country like Pakistan requires a principle of monetary expansion. There are essentially two alternatives. One is to proceed to increase the money supply on an ad hoc basis according to the credit needs that arise in each sector. This really amounts to lack of a principle. The second approach which may be called the 'monetary' principle, is to determine the desired demand for the components of money stock corresponding to the changes in the variables stated above so that their supply can be expanded accordingly. Monetary expansion above this level is likely to finance speculative operations which feed on inflationary expectations and can become a major destabilizing force. The findings of this paper provide a tentative answers to second approach of the 'monetary' principle. On the basis of the estimated elasticities we predicted the components of money stock for the period 1959-60 to 1978-79. The actual and predicted values are exceedingly close to each other and hence can be used for forecasting the components of money stock beyond 1978-79. It

would certainly have been more helpful to the policy makers if we had studied the demand for the components of money stock by using quarterly data. Such data, however, were not available.

Conclusions

This paper examined the money-demand function in disaggregated form, wherein separate equations for currency, demand and time deposits are estimated. It was argued at the beginning of this paper that aggregate money-demand function may conceal important information about the demand for its components. The findings of this paper support our contention that aggregation conceals information. Besides income, interest rate on time deposits, rate of inflation and effect of monetization we found non-agriculture income, inter-bank call money rate and government bond rate as significantly affecting the demand for the components of money stock. Therefore,disaggregation provides us greater flexibility in the choice of policy variables for the conduct of monetary policy. It is more instructive to study the demand for money by studying the demand for its components. In fact, for an economy like Pakistan it would be useful to carry this disaggregation still further. For example, demand function for the urban and the rural sectors might reveal entirely different income and interest rate elasticities for the components of money stock.

As far as interest rate is concerned, we have found interest rate on time deposits, inter-bank call money rate and government bond rate a significant explanatory variable in demand for currency in circulation, demand deposits and time deposits respectively.

As far as expected rate of inflation is concerned, we did not find its impact on the demand for the components of money stock to be significant for the period 1959-70 because inflation rate was very low until 1971. However, we did find its impact on the demand for the components of money stock to be significant after 1971 because the inflation rate was around 15 percent.

The effect of monetization on the demand for the components of monety stock did not show significant effect for the period 1959-70 except in the case of demand deposit function[21]. However, it was highly significant after 1971.

Adjustment between actual and desired money balances was not instantaneous and the coefficient, of adjustment varies among currency, demand deposits and time deposits. The speed of adjustment for the currency in circulation was between 0.58 - 0.64 while those of demand-and time deposits were 0.31 and 0.19 respectively.

We predicted the components of money stock for the period 1959-60 to 1978-79 and found actual and predicted values exceedingly close to each other. However, it is expected that quarterly data would further improve the forecasting of the components of money stock.

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21 The coefficient of bank branches used as a proxy for monetization was significant at 90 percent confidence level in demand-deposit function.

APPENDIX

	CC/DD	CC/TD	DD/TD
1959-60	1.91	3.13	1.64
1960-61	1.98	3.31	1.68
1961-62	1.65	2.39	1.45
1962-63	1.64	2.10	1.28
1963-64	1.45	1.81	1.25
1964-65	1.43	1.66	1.16
1965-66	1.44	1.50	1.04
1966-67	1.38	1.26	0.91
1967-68	1.40	1.15	0.82
1968-69	1.23	1.06	0.87
1969-70	1.23	1.13	0.92
1970-71	1.12	1.12	1.00
1971-72	0.94	1.09	1.16
1972-73	0.85	1.01	1.18
1973-74	0.94	1.11	1.18
1974-75	0.85	1.00	1.18
1975-76	0.71	0.85	1.19
1976-77	0.69	0.82	1.20
1977-78	0.72	0.82	1.14

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